Senior High School

CURRICULUM GUIDE

Vocational Series

AUTOMOTIVES 12 - 22 - 32

(Interim Edition, September 1963)

CURRICULUM

TL
152
A333
1963

Province of Alberta

Department of Education

CURRGDHT

DEPARTMENT OF EDUCATION

CIRCULAR LETTER # 1

March 11, 1964

TO: High School Automotive Instructors

FROM: R. H. Cunningham

The following changes in the Automotive 12 and 22 Interim Guide of September, 1963, have been approved by the Automotive Sub-Committee. These changes are to be effective immediately. Please make the necessary changes in your course outline.

Page 8 - 3. (b) Substitute "flat iron" for "block iron".

Page 11 - 18. Under Basic Information insert "cooling systems, thermostats, cleanliness"

Page 12 - Insert "Clutch" as "C" and change lettering from here on.

Page 13 - 2. Change "Check firing order and install harness" to "Trace firing order, and check circuits". Add "Basic ignition timing procedure", under "Basic Information."

Page 15 - D. Delete 6. "Reface dics" and 12. "Disassemble pressure plate and cover."

Page 16 - Under "Work Activities", delete 15, 16, 17, 26, 27, and insert "Service hydraulic master and slave cylinder" in place of 26.

Page 17 - Delete items 28 and 29.

Page 22 - H. 2. (c) Delete words "Bonding and"
I. 1. (a) Change "aligning" to "checking"
1. (b) Delete
Page 23 - 4. (a) Change the word "Service" to "Inspect".
4. Under "Basic Information" delete "testing, types of fluid and bleeding."
9. Correct spelling of "camber"
Page 24 - Delete units 15. and 16, including the "Basic Information" opposite 16.

The following time allocations are recommended for the various units in "12" and "22" to be included in the outline when reprinted.

Page 12
A. 26 hours (2 hours for History, Development, and Opportunities.)
B. Chassis - 2 hours
C. Lubrication & Servicing - 18 hours.
D. Internal Combustion Engine - 50 hours
E. Fuel System - 6 hours
F. Hydraulic Brake System - 4 hours
G. Clutch - 2 hours
H. Transmissions - 6 hours
I. Drive Line - 2 hours
J. Rear Axle Assembly - 8 hours
K. Front End - 3 hours
L. Steering - 3 hours
M. Ignition - 4 hours
N. Trade Information - 2 hours

Automotives 22

A. Orientation - 2 hours
B. Shop Safety - 20 hours
C. Power Tools - 5 hours
D. The Clutch - 30 hours
E. The Transmission and Overdrive - 60 hours
F. Driveshafts and Universal Joints - 20 hours
G. Rear Axle - 60 hours
H. The Braking System - 60 hours
I. Steering and Wheel Alignment - 60 hours
J. Wheels and Tires - 20 hours

The Automotives 32 course outline is presently being altered to include 60 hours on tune-up. This material will be forwarded as soon as it is available.

CONTENTS

Foreword 3

General Objectives 4

General Information 5

Instruction on the Use of the Guide . 7

Automotives 12 Course Outline. 8

Automotives 22 Course Outline 14

Automotives 32 Course Outline 25

References 35

COURSE CREDIT VALUES

Automotives 12	5 credits.
Automotives 22	15 credits.
Automotives 32	15 or 20 credits.

One credit corresponds to a minimum of 40 minutes of instruction time per week.

FOREWORD

No single item of family or business property can compete with the automobile for the place it holds in our daily lives. Not only is it the accepted mode of transportation for business and pleasure but it provides the means of livelihood for millions of people.

Statistics show that one-seventh of the total labor force in the United States is employed either directly or indirectly in the automotive industry.

In 1950, Alberta had 151,724 cars registered. By 1961, this figure had increased to 507,951. By 1970, the figure for 1961 is expected to be doubled. These figures do not include commercial vehicles.

The "automotive mechanic" is listed by National Employment Services as a "demand" occupation. As of March, 1963, there were 1336 apprentices registered with the Alberta Apprenticeship Board. The demand remains high for new apprentices with a sound educational background.

This curriculum guide has been prepared for use in those high schools that have been approved by the Department of Education as possessing the facilities, equipment and qualified staff necessary to teach the program successfully.

The content of the three year sequence includes the first year of the Automotive Service Technology program offered by the Technical Institutes. It also approximates the first two years of the Motor Mechanic Apprenticeship program. If the graduates of this program are to receive advanced standing in the Technical Institute program or recognition by the Apprenticeship program, it is imperative that instruction be such as to ensure thorough coverage of the program outlined in the following pages.

GENERAL OBJECTIVES

1. To equip a student with sufficient skill and knowledge such that he will be highly employable in the automotive industry.

2. To enable the student entering the Automotive Apprenticeship program, to advance at an accelerated rate on the basis of his proven ability on the job.

3. To prepare a student to a degree of competency acceptable to the Institutes of Technology sufficient for entry into the second year of the Automotive Service Technology program.

4. To encourage the student in the development of desirable work habits, a sense of responsibility and the ability to cooperate with his associates.

5. To develop an attitude of safety consciousness in the student, regarding all phases of the automotive industry.

GENERAL INFORMATION

1. Time Allocation

It is recommended that in the Automotives 12, 22 and 32 courses, one-third of the time be given to theory and two-thirds to shop practice.

2. Safety Program

Every shop must have an effective safety program. In the automotive shop particular attention must be given to incorporating the safety measures as used in industry: running motors must be exhausted; machines used with adequate guards; cleanliness of shop and personnel maintained at a high standard; students properly clothed for their work; etc. Shop organization must be well developed to ensure a stress on this important phase of the shop program.

A good safety program features the following devices: regular, consistent and thorough instruction; constant vigilance and checking by instructor; safety posters; student safety committee; adequate first-aid equipment; instructor trained and up-to-date in first-aid methods; dynamic color painting of machines and equipment; adequate working space about machines; safety lines on floor around machines; routine report on accidents however minor; machines and tools in approved working condition; a safety conscious group of students and instructor, etc.

3. Instructor's Records

The instructor should keep accurate records of:
Student enrolment and attendance
Customer and student accounts
Student work activity
Theory covered
Tests given
Student achievement, aptitudes and attitudes
Up-to-date inventory of all equipment

4. Student Records

Instructors should ensure that the student develops and maintains a neat and accurate record of:
Notes on theory
Daily shop activities (time cards)

5. Enrolment

It is recommended that the maximum enrolment should not exceed 15 students for any laboratory or shop class; however, two classes may be combined for the presentation of theory.

6. Guidance and Vocational Information

Instructors must assume responsibility in their trade area to ensure that students and school guidance officials are aware of the local situation. Instructors through the Principal have some responsibility for student placement. It is advisable that instructors be active, interested and informed.

NOTE: In order to permit students from an academic Grade X program to cross over into the vocational program at the Grade XI level, schools may combine the 12 and the 22 courses into one course for a total of 20 credits. Where these courses are combined it is recommended that students purchase the Grade XI text only.

INSTRUCTIONS ON THE USE OF THE FOLLOWING GUIDE

The course outline is divided into three columns designated; Work Activities, Basic Information and References. The first column outlines the type of activity performed by the students in the shop. The second column refers to the essential knowledge upon which a well educated employee in the automotive industry will depend to adequately carry out the mutual activities outlined in the first column. The third column lists numbers which correspond to References other than the prescribed texts. They are listed in the back of the curriculum guide. The reference column is not considered to be complete. Instructors are requested to insert references which they consider most suitable for the particular topics outlined. It would be desirable if instructors would also note the time spent on the various units. This information will be extremely valuable to the curriculum committee in revising this outline.

The authorized text for Automotives 12 is AUTOMOTIVE FUNDAMENTALS by Fredrick C. Nash, McGraw-Hill Company of Canada.

The authorized text for Automotives 22 and 32 is AUTOMOTIVE MECHANICS by Wm. Crouse, McGraw-Hill Company of Canada.

OBJECTIVES FOR AUTOMOTIVES 12

The automotive course in Grade X is considered to be exploratory in nature. The knowledge and experience gained should enable the student to make an informed decision in regard to his possible future in the automotive industry.

More specifically the objectives for the Grade X course are as follows:

1. To develop an understanding of the operation and construction of the various components of the automobile.

2. To develop basic skills in the care and safe use of hand and power tools and equipment.

3. To familiarize the student with service and repair procedure.

4. To impart occupational information related to the opportunities in the automotive industry.

AUTOMOTIVES 12 COURSE OUTLINE

Work Activities	Basic Information	References
A. Introduction and Basic Tools		
	History and development of the automobile. The wide range of opportunities in the automotives field. Qualifications for success. Working conditions.	
1. Shop Familiarization (a) Tour of the shop, (b) shop organization and (c) procedure, safety.		
Emphasize safe use and care of all tools and equipment Project or exercise in using layout tools, hack saw, files, square, punches, hammers, drills, taps and dies, drill press and bench grinder.	Tools and Fasteners: Common hand tools, special tools, and power tools - their purpose and care; automotive fastenings, their advantages and uses. Twist drills, types, drilling speeds, sharpening angles.	Nash Hallett
2. Sharpen drills		
3. Reconditioning soldering coppers (a) Tinning soldering copper (b) Soldering black iron, galvanized iron and tin	Soldering coppers - Solder and soldering fluxes	12
4. Splice wire and solder terminal to wire	Types of electrical wire used in the automotive industry. Soldered and solderless terminals.	1
5. Installing solderless terminals.		

Work Activities	Basic Information	References
B. Chassis		
1. Students examine various makes and models of cars to determine type of chassis employed - frames and suspension, locate and name parts.	Purpose and types of chassis, construction and terminology. Meaning of tracking, road clearance, wheel base, car tread.	1
2. Demonstrate the correct use of jacks and hoists stressing all safety precautions and the use of car stands.	Types of hoists, jacks and car stands - their safe use and care, lifting and hoisting points.	4
C. Lubrication and Servicing		
1. Hoist the car 2. Drain crankcase 3. Clean and locate lubrication points with the aid of charts 4. Lubricate car	Lubrication charts - types of lubricants, general protection for the auto-fender covers, seat covers, etc.	Lubrication Manuals 1 4
5. Check transmissions, differential, gear boxes, radiator and master cylinder levels.	Gear lubricants - (a) Foaming (b) Levels (c) Draining and filling (d) Dangers in over filling	
6. Lubricate throttle and brake linkage, springs and shackles, shocks and anti-sway linkage. universal joints, front suspension, body hardware, door locks, starters and generators, distributor and water pump.	Effects of lubricants on brake linings. Use of rubber lubricants. Procedure for lubricating U-joints. Use of stick lubricants.	2 4
7. Replace oil filter, service air cleaner and breathers.	Amount and types of oil, characteristics. Types of oil filters, sizes. Types of air cleaners and breathers.	1

Work Activities	Basic Information	References
8. Check radiator and battery levels.		
9. General inspection of the car for: (a) Leaking seals (b) Exhaust leaks (c) Faulty tires (d) Loose U-joints (e) Leaking and loose shock absorbers (f) Loose front end parts (g) Improper clutch and brake pedal adjustment (h) Faulty lights (i) Fan belt condition and adjustment (j) Fluid leaks - radiator, brakes, water pump, transmission, etc. (k) Seized heat riser valves	Point out the values of this inspection for the customer and for the garage or service station owner.	1 13
10. Repacking frontwheel bearings. Adjusting front wheel bearings.	Types of bearings and their purposes. How to remove, inspect and lubricate front wheel bearings.	2
11. Repair both tube and tubeless tires.	Tire and tube servicing and tire rotation - reasons for and method of rotation.	4 13
12. Rotate tires.		
13. Remove, clean and service battery, cables and hold-downs.	Battery Servicing - Removal and installation	
14. Test specific gravity, closed circuit voltage test.	Proper storing and servicing of wet and dry charged batteries. Proper use of different types of charges. Identification and precautions for alternator equipped units.	13

Work Activities	Basic Information	References
15. Washing, polishing and appearance servicing, corrosion prevention.	Cleaning and polishing materials.	
16. Flush and clean cooling system, replacement of thermostats and hoses.	Cooling systems, anti-freezes, thermostats and pressure radiator caps.	13 2
17. Summerizing and winterizing of cooling systems.		
18. Service air cooled units.		
D. The Internal Combustion Engine		
1. Elementary work on automobile engine practice units, to include complete disassembly of various makes, inspection, construction, names and operation of parts; use of special tools, gauges, measuring instruments, micrometers, telescopic gauges to measure clearances and wear.	Operating principles. The four stroke cycle engine, names of parts and their purposes, types of engines - cylinder arrangements, valve arrangements, types of heads, valves and valve springs, rocker arms, rockers, push rods, valve guides, valve locks, camshaft and timing gear, timing marks, timing chains, valve timing.	1
2. Trace oil and cooling systems.	Piston assemblies, identification of parts and marking, cylinders, main bearings, connecting rods, crankshafts and flywheels.	4
3. Assemble engines and make adjustments, valve timing.	Manifolds and purpose and construction. Muffler - purpose and construction.	
E. Fuel System		
1. Study fuel tanks and fittings, (a) Cut and flare tubing.	Construction of tanks, fuel lines and types of fittings, fuel filters, fuel pump construction and operation.	1
2. Dismantle, examine and reassemble practice fuel pumps.	Fundamental principles of carburetion, basic circuits, principles of operation, air-fuel ratio and carburetor circuits.	
3. Examine simple carburetors, (a) Sketch circuits for a simple carburetor.		

Work Activities	Basic Information	References
F. Hydraulic Brake System		
1. Disassemble and assemble brake units, master cylinder, (practice units).	Provincial Motor Vehicle Laws Principles of operation, parts of the system.	1
2. Adjust brake shoes.		
3. Adjust brake pedal.	Reasons for adjustment and procedure.	4
	The clutch - parts, purpose and operation.	1
G. Transmissions		
1. Disassemble, study and reassemble transmissions to trace the path of power and determine gear ratios. (practice units)	3-speed syncro-mesh and 4-speed conventional - operation and construction of parts, names of parts, path of power and gear ratios.	1 13 8
H. Drive Line		
1. Examine hatchkiss and torque tube drives and universal joints.	Hatchkiss and torque tube drive: construction of universal joints and lubrication.	1 2
I. Rear Axle Assembly		
Disassemble, examine and assemble hypoid and conventional truck rear axle assemblies. (practice units)	Names of parts, operation of differential.	4
J. Front End		
1. Study various types of front end assemblies. (practice units)	Operation and adjustments for steering angles, names and operation of all parts.	4
K. Steering		
1. Disassemble, study and reassemble steering gears. (practice units)	Recirculating ball, cam and lever, worm and roller; names of parts and operation.	

Work Activities	Basic Information	References
L. Ignition		
1. Clean and gap spark plugs;	Firing orders, distributor, coil, points, condenser, harness and spark plugs. Primary and secondary circuits.	1
2. Check firing order and install harness on practice and live units.		
M. Trade Information		
1. Obtain speaker from the Apprenticeship Board to address students.	Occupations in the automatives field, training required and education. The Apprenticeship system in Alberta for tradesmen. The Technical Institutes' program for training. Opportunities in related occupations.	

AUTOMOTIVES 22

Whereas Authomotives 12 is an exploratory course open to all Grade X students, Automotives 22 and 32 are definitely vocational and only those students who have displayed ability and aptitude for the program should be encouraged to continue. It is not in the best interests of the student to permit him to continue in a program which demands a large portion of his school time, and in which the instructor and/or the guidance counsellor feel that he has little chance of success.

AUTOMOTIVES 22 COURSE OUTLINE

TEXT: AUTOMOTIVE MECHANICS - 4th edition by Wm. Crouse, McGraw-Hill Company of Canada.

Work Activities	Basic Information	References
A. Orientation		
1. Tour of the shop.	Introduction to the course. Shop procedure.	
2. Examine tools and equipment and manuals.	Use of lockers. Use of tools and manuals. Shop library procedure.	
B. Shop Safety		
1. Practice safety in all activities.	Need for constant vigilance. Use of jacks and stands.	
2. Read all Workmen's Compensation Board notices and posters.	Use of compressed air and compressed air operated tools and equipment.	W.C.B. posters.
	Fire hazards and control. (a) Storage of flammable materials. (b) Fire extinguishers.	
	Grinders (a) Shields and goggles. (b) Angle of approach. (c) Heat hazards.	W.C.B. posters.
	Ventilation and exhausting of internal combustion engine gases.	
	Dangers of carbon monoxide gas.	W.C.B. posters.
	First aid methods and reports on injuries.	

Work Activities	Basic Information	References
C. Power Tools		
	Nomenclature and accessories.	2
1. Using electric power tools.	Maintenance and storage of electric tools and cords.	5
	Safe work habits.	
2. Using air powered tools.	Nomenclature and accessories of air powered tools.	
	Grounding of electrical equipment.	
D. The Clutch		
1. Remove the clutch.	Clutch construction and operation, clutch types, clutch discs and pressure plates, clutch release bearings, clutch adjustment, clutch troubles and trouble shooting.	1 2 4
2. Check facings for wear.		
3. Check discs for defects.		
4. Test disc alignment using dial indicator.		
5. Check limits and tolerances.		
6. Reface discs.	Causes of damage to flywheel.	
7. Inspect for flaws.		
8. Test for misalignment using dial indicator.	Permissible limits.	
9. Remove and install clutch shaft pilot bearing: use of special pullers, determine bearing condition, use of special drivers.	Purpose of pilot bearings. Types of pilot bearings.	
10. Inspecting assembly for wear.	Types of pressure plate units: coilspring diaphram, crown pressure spring, semi-centrifugal.	2
11. Inspect pressure plates for scores.		
12. Disassemble pressure plate and cover.		
13. Test pressure plate springs. Importance of equalized spring pressures.	Identification of different colors.	2
14. Inspect and replace release lever bearings.	Sizes and ratings of bearings.	

Work Activities	Basic Information	References
15. Assemble pressure plate and cover, lubricate pivot points.		
16. Adjust release levers: Use of special fixtures.	Importance of accurate measurements. Manufacturers' specifications. Types of bearings, operation, and thrust bearing principles.	
17. Clean release bearings.		
18. Inspect release bearings.		
19. Replace release bearings. Use of arbor press. Use of hydraulic press.		
20. Inspect and replace release bearing hubs. Use micrometer to check O.D. against manufacturers' specifications.		
21. Lubricate release bearings.	Types of bearing lubricants. Factory or pre-lubricated release bearings.	
22. Install clutch assembly.		
23. Inspect clutch linkage for wear or binding. Causes and results of clutch linkage wear or binding.		
24. Remove and replace clutch linkage.	Operation of over-center springs.	
25. Lubricate and adjust clutch linkage.		
26. Remove fluid coupling. Note components and balance marks.		
27. Drain and refill fluid coupling.	Types of oil, checking level, causes and results of oil leakage.	

Work Activities	Basic Information	References
28. Replace shaft seals. Note precautions in replacing fluid coupling oil seals.		2
29. Install fluid coupling Precautions to be observed.		
E. The Transmission and Overdrive		
1. Remove a transmission: (a) Drain and remove parts to permit access. (b) Necessity for pilot studs. (c) Use of engine and car supports.		8 4
2. Check clutch housing alignment and bore run-out. (a) Use of special arbor. (b) Use of service manuals. (c) Use of dial indicator.		
3. Install a transmission: (a) Selection of proper lubricant. (b) Methods of refilling transmission.	Transmission lubricants. Results of insufficient or incorrect lubricant. Types of transmissions: three and four speed, synchromesh constant mesh.	2
4. Disassemble three-speed transmission: (a) Remove welsh plugs. (b) Purpose and operation of detent balls, shifter rails, forks and interlocks. (c) Methods of locking countershaft, idler shaft.	Nomenclature. Trace power flow and speeds.	
5. Disassemble and inspect synchromesh unit: (a) Study operation. (b) Remove and install snap-rings.		
6. Inspect transmission components for wear and damage.	Causes of wear and damage. Gasket materials.	

Work Activities	Basic Information	References
7. Assemble three-speed transmission:		
(a) Gear alignment and tooth contact.		8
(b) Permissible countershaft end play.		
(c) Location of countershaft thrust washers.		2
(d) Install welsh plugs.	Reasons for new gaskets and snap rings.	
8. Adjust shift linkage:		
(a) Assists - vacuum and electric.		
(b) Lubrication.	Importance of proper linkage adjustments.	
9. Remove and disassemble overdrive: (a) Trace flow of power.	Operations and construction of shift mechanism, interlocks and trouble shooting.	
(b) Reasons for overdrive to fail to engage or disengage.	Overdrive operation, advantages, speeds at which overdrive cuts in or out, lockout mechanism, stepdown mechanism.	
10. Assemble and install overdrive:		
(a) Tracing and testing electrical circuits.	Purpose and operation of relays and solenoids.	8
(b) Check and adjust control linkage.	Purpose and operation of governors.	
(c) Clean and adjust solenoid contact points.		
(d) Adjust solenoid throttle and kick down switches.		
(e) Overdrive lubrication.		
(f) Test drive for proper operation.		
		1

Work Activities	Basic Information	References
F. Driveshafts and Universal Joints		
1. Remove, check and install torque-tube and shaft: (a) Adjust ball joints. (b) Check propeller shaft for balance and alignment.	Purpose and operation of ball and slip joints.	1
2. Remove, check and install Hotchkiss drive propeller shaft. (a) Remove drive shaft and replace universal joints.	Transmission of power by torque-tube and Hotchkiss drives.	
3. Remove and disassemble ball and trunnion universal joints: (a) Use of hydraulic and arbor presses.	Types and operation of universal joints, purpose of boots.	
4. Assemble and install ball and trunnion universal joints: (a) Determine serviceability of parts,		
(b) Check position of trunnion pin in shaft.	Permissible off-center limits of trunnion pin.	
5. Remove and disassemble two-yoke and cross universal joints: (a) Remove lock - rings.		14
(b) Clean and inspect universal joint needle bearings.		1
6. Assemble and install two-yoke and cross universal joints: (a) Lubricate. (b) Purpose of arrows on some universal joints.	Importance of using new locking devices. Types of lubricants. Causes of universal joint failure.	

Work Activities	Basic Information	References
G. The Rear Axle		
1. Remove rear axle assembly: (a) Support the car. (b) Check rear axle housing alignment. 2. Install and align rear axle assembly: (a) Axle ratio and determination of axle ratio. (b) Adjust angle of pinion and drive line. 3. Remove differential carrier assembly: (a) Drain lubricant and flush assembly. 4. Install and lubricate differential carrier assembly. (a) Extreme pressure and hypoid lubricants. (b) Clean air vent. 5. Disassemble differential: (a) Trace power flow. 6. Remove and install differential ring-gear: (a) Remove rivets. (b) Reattached ring-gear to differential case. (c) Check ring-gear run-out using dial gauge indicator. 7. Remove and install differential side bearings. 8. Assemble and adjust differential: (a) Check back lash. (b) Adjust back lash. (c) Check and adjust tooth contact. (d) Adjust crown gear thrust pad.	Types of rear suspensions. Rear axle housings. Function or torque arms. Eaton and Timkin axles. Operation of differential including "no spin" types. Semi, three-quarter and full floating types of axles. Adjustment of axle shaft end play. Path of power in all types. Methods of positioning pinion, methods of preloading bearings, types of bearings, tooth markings. Methods of adjusting backlash, crush sleeves, rear axle and pinion grease seals. Thrust pad adjustment. Troubles and trouble shooting. Types of differential ring-gears and pinions: spur, bevel, hypoid and worm. Differential gear ratios. Advantages of hypoid gearing. Meaning of torque and foot-pounds. Conditions affecting serviceability of bearings.	4 2 8

Work Activities	Basic Information	References
9. Remove and install drive pinion, bearings and oil seals:		
(a) Remove and install oil seals.		
(b) Adjust drive pinion bearings.		
(c) Lock pinion bearing nuts.		8
10. Remove, check and install semi-floating rear axle:		
(a) Check and adjust rear axle end play.	Forces acting on the axle.	
(b) Check rear axle shaft alignment.		
(c) Adjust rear axle bearings.		
11. Remove, check and install full-floating rear axle:		
(a) Adjust axle bearings.		
12. Remove, check and install three-quarter floating rear axle.	Types of bearing used on various rear axles.	2
13. Remove and install rear axle bearings and oil seals:	Prelubrication of oil seals.	
(a) Use special axle bearing pullers.	Oil seals and oil deflectors.	
(b) Use special bearing and oil seal drivers.		
(c) Check bearing condition.		
14. Remove and replace broken rear axle:	Causes of rear axle breakage.	
(a) Remove and replace axle flange bolts.	Importance of eliminating excessive back lash.	

Work Activities	Basic Information	References
H. The Braking System		
1. Repair cylinders: (a) Recondition wheel and master cylinders.	Importance of cleanliness. Methods of reconditioning cylinders. Methods used in brake-line service.	10 11
2. Replace brake drums, shoes and linings: (a) Recondition and replace drums, linings, shoes, leverage and linkage. (b) Turn brake drums. (c) Bonding and arcing of linings.	Brake drum construction and grinding. Types of brake shoes and lining, operation of hydraulic system, master and wheel cylinder construction and operation.	2 10 11
3. Adjust brakes: (a) Flush system. (b) Fill and bleed system. (c) Major and minor adjustments. (d) Reline and adjust service and parking brakes. (e) Lubricate brake parts.	Type of fluid. Bleeding brakes.	
4. Repair power brakes: (a) Clean, repair and adjust.	Power brake operation and construction - hydrovac, treadlvac and maraine. Brake troubles and repair procedures.	
I. Steering and Wheel Alignment		
1. Positioning and repairing frames and axles: (a) Aligning bent frames and positioning rear axles. (b) Straightening and repairing front and rear axles.	Effect of broken or distorted frames on steering. Construction of solid type front axle and individual suspension including ball joints, torsion bar suspension, stabilizers, elliott reverse, elliott and lemaine types.	2 5
2. Replace springs: (a) Torsion bars. (b) Leaf springs. (c) Coil springs.	Reasons for spring sag. Purpose and types of shackles and spring seats.	

Work Activities	Basic Information	References
3. Replace spring shackles.	Principles of compression and rebound control.	
4. Replace shock absorbers: (a) Service shock absorbers and stabilizer bars.	Shock absorber troubles. Types, testing, types of fluid and bleeding.	
5. Remove and replace steering gear: (a) Check worn or damaged parts. (b) Replace and align	Steering gear operation and construction. Worm and roller, recirculating ball, cam and lever. Steering gear adjustments, worm bearing preload, sector end play, worm and roller mesh.	5
6. Rebuild front end units: (a) Check for worm parts of suspension. (b) Check and replace ball joints.		
7. Center car on wheel aligner.	Types and construction of wheel aligners, methods of installing checking heads, jacks, lights, etc.	
8. Determine points of wear: Check and correct (a) Wheel bearing wear. (b) Wheel run out. (c) Steering linkage (d) Tire inflation. (e) Tracking and shock absorbers.		
9. Adjust comber: measure and correct.	Steering angles, caster, camber, king pin inclination. Turning angles, toe-in. Purpose and operation of each. Types and location of adjustments. Wheel alignment procedure including checking and tracking.	
10. Adjust caster: measure and correct.		
11. Adjust toe-in: measure and correct.		

Work Activities	Basic Information	References
12. Check king pin inclination and adjust if necessary.		
13. Check turning radius: measure and correct.		
14. Adjust the steering box: (a) Adjust steering box. (b) Adjust steering linkage.	Purpose of steering box adjustments.	
15. Align power steering.		
16. Service the power unit: (a) Making mechanical adjustments, (b) Servicing pump, control valves, lines and steering gear. (c) Bleeding and trouble shooting the system.	Types and operation of power steering, construction, types of hydraulic fluids.	
17. Road Testing: checking for proper steering.		
J. Wheels and Tires		
1. Remove wheels: safety precautions.	Types of wheels, rims and hubs. Types of wheel fasteners.	2
2. Balance wheel assemblies: (a) Clean and inflate tires. (b) Balancing wheels.	Methods of cleaning and inflating tires. Types of wheel balancers, methods of mounting and operating balancers, methods of correcting static and dynamic unbalance, types of wheel weights.	13 4
3. Replacing wheels: (a) Position wheels. (b) Fasten and tension wheels. (c) Replace hub caps, special rims, etc.		

AUTOMOTIVES 32 COURSE OUTLINE

TEXT: AUTOMOTIVE MECHANICS, 4th edition by Wm. Crouse, McGraw-Hill Company of Canada.

Work Activities	Basic Information	References
A. Orientation		
1. Tour of the shop, introduction to tools and equipment.	Outline the content of the course, shop procedure, shop library procedure outlined.	
B. The Engine		
1. Remove engine from chassis: (a) Drain cooling system.	Procedure in removing engines from chassis. Safety precautions to be observed.	15
2. Removing oil pan		
3. Check oil pan: (a) Use gauges and equipment to check oil lines and troughs.	How to straighten edges of oil pan. Purpose of baffles.	2
4. Remove cylinder head: (a) Remove units attached to the head such as oil filter, coil, horn, etc. (b) Remove spark plugs. (c) Remove head bolts.	Precautions necessary in removing head bolts, nuts.	
5. Clean and check the head: (a) Use carbon scrapers and brushes. (b) Resurface head.	Effects of carbon deposits.	
6. Remove engine valves.	Necessary precautions in removing valves. How to remove stuck valves. Valve stem seals and their function.	

Work Activities	Basic Information	References
7. Clean, check and reface valves: (a) Clean valves. (b) Check valves for condition. (c) Grind valves using refacing machine.	Valve face angles, sodium filled valves, amount of margin to leave, necessity of cleaning valves thoroughly, effect of valve stem wear and how to check.	2 15
8. Cleaning, checking and replacing valve guides: (a) Use valve guide cleaners. (b) Check valve guide wear. (c) How to remove guides. (d) Use of reamers.	Precautions necessary.	
9. Checking and replacing valve springs. (a) Test spring tension.	Construction of valve springs. Why two springs are used on some valves. Effect of weak springs. Close coils, correct installation. Valve spring retainer, washers and various constructions. Anti-rattle springs.	
10. Reconditioning valve seats: (a) Use of valve seat refacing machine. (b) Check seat and face contact.	Valve seat angles and width. Importance of clean valve guides. Types of grinding stones. Materials used in valve seats. Precautions to be observed Use of grinding compound to check seat and face contact.	15
11. Replacing valve seats: (a) Use of valve seat replacing tools and cutters.	Expansion and contraction of metals. Types of seats, threaded and pressed.	
12. Removing, checking, repairing and replacing valve lifters: (a) Reface valve lifters. (b) Install lifters.	Cause of valve lifter wear. Operation of hydraulic valve lifters . Precautions necessary when installing lifters.	

Work Activities	Basic Information	References
13. Reconditioning rocker arms and shafts: (a) Rebushing and fitting. (b) Clean and check. (c) Install rocker arms.	Necessary precautions. How to clean and check. Procedure for rebushing and checking. Differences between intake and exhaust rocker arms.	15
14. Removing and replacing valve timing cover: (a) Use of pullers. (b) Precautions. (c) Use of alignment tools.	Causes of oil loss around timing cover.	
15. Replacing oil seal in timing cover.	Types of oil seals, oil slingers, installation of seals, precautions, alignment of timing cover.	15
16. Removing and replacing camshaft drive gears and chain: (a) Use of pullers. (b) Note timing gear markings.	Timing gear markings and chain markings, adjustment of chain, composition of gears, oversize timing gears, causes of chain and gear wear, noise caused by worn gears or chain.	
17. Remove and check camshaft: (a) Precautions. (b) Check wear using dial gauges and micrometers.	Effect of cam wear on valve operation, effect of eccentric wear on fuel pump, methods of checking valve timing.	
18. Checking camshaft bearings and replacing: (a) Check using dial gauge and micrometer. (b) Use of bearing pullers and drivers. (c) Line reaming of bearings. (d) Check bearing clearance. (e) Check and adjust end play. (f) Clean oil passages.		

Work Activities	Basic Information	References
19. Adjusting tappets: (a) Use of feeler gauges.	Effect pf temperature on clearance, tappet locking devices, requirements for setting tappets on a dead engine, necessity of grinding valve stem or face, precautions when adjusting hydraulic tappets.	15 2
20. Clean crankshaft: (a) Oil passage holes and hole plugs.		
21. Check truth and size of journals and crankpins: (a) Use of micrometer and dial gauge.	Necessary checks, cause of shaft wear, cast shaft, forged shaft, allowable wear, balancing static and dynamic, amount of material which may be removed by grinding, possible results if incorrectly done, metallizing and it's characteristics.	
22. Checking main bearings and replacing: (a) How to remove bearing. (b) Line reaming. (c) Use of test shims. (d) Use of plastigage (e) Use of torque wrench. (f) Adjustable bearings (shims) (g) Bearing crush.	Main bearing construction, reasons for failure, how bearing is locked in position, bearing sizes, end thrust bearings, oil grooves and passages.	16
23. Checking connecting rods and replacing: (a) Checking bearing clearance. (b) Use of torque wrench.	Bonded bearings, bearing inserts, reasons for bearing failure, insert sizes, connecting rod, nut locking devices. Procedures possible with engine in place. Conditions requiring removal.	

Work Activities	Basic Information	References
24. Removing connecting rod and piston: (a) Remove cylinder ridge. (b) Numbering pistons and rods.		
25. Removing rods from pistons and replacing: (a) Removing piston pin locks and pins.	Piston pin mountings. Maximum side thrust of piston.	
26. Fitting piston pins: (a) Use of pin bone. (b) Use of reamers and broaches.	Purposes of pin fit. Effect of different metals on pin fitting. Hot and cold fitting.	16
27. Aligning con rod and piston: (a) Use of rod aligners. (b) Check centering of rod between piston bosses in engine.	Effects of incorrectly aligned rods and pistons.	
28. Installing new rings on piston.	Types and purpose of piston rings, manufacturer's recommendations for various cylinder conditions. How to check ring clearances.	
29. Reconditioning cylinders: (a) Clean the block. (b) Use of micrometers and cylinder gauges. (c) Checking cylinder bone. (d) Use of boring bar. (e) Check piston clearances. (f) Deglaze cylinders.	Care of cylinder boring bar. How to check piston clearances. Care and use of cylinder bone.	15
30 Reconditioning pistons: (a) Knurl pistons. (b) Regrooving of pistons and use of spacers.	Advantages and disadvantages of knurling pistons. Piston expanders and when they should be used. Importance of lubrication.	
31. Installing pistons, pins, rings and rods: (a) Use of ring compressor. (b) Precautions necessary.	Stoggering ring gaps. Significance of manufacturer's assembly markings.	

Work Activities	Basic Information	References
32. Replacing rear main bearing seals.	Causes of oil leaks past rear main bearing seals; types of seals used and precautions when installing various parts.	16
33. Removing and replacing flywheel: (a) Support the engine. (b) Remove transmission, clutch and bell housing. (c) Locking devices for flywheel,bolts and nuts.	Purpose of the flywheel, reasons for replacement, importance of balance and alignment, timing marks. Inspection of flywheel face for cracks.	
34. Installing flywheel ring gear. (a) Use of heat to expand the gear.	Design of the teeth on the gear. Importance of allowing gear to cool slowly.	
35. Removing and installing crankcase vibration damper: (a) Use of pullers. (b) Precautions necessary.	Purpose of dampers; how vibration dampers are held in place.	
36. Removing and replacing intake and exhaust manifolds: (a) Installation of gaskets. (b) Cleaning manifold passages. (c) Freeing manifold heat control valve.	Importance of cleaning manifold. How to check manifold, carburetor, heat tubes and valves.	15
C. The Lubricating System		
1. Service different types of oil pumps.		2
2. Pressure testing using oil leak detector.		9
3. Testing and replacing of pressure sending units.		

Work Activities	Basic Information	References
D. The Cooling System		
1. Removing and replacing radiators: (a) Repair radiators (not to include cores).	Radiators pressure caps, purpose and how to test.	9
2. Removing and replacing water distributing tube.	The effect on improperly installed water distributing tube, the effect of foreign deposits in the passageways.	
3. Removing and replacing expansion plugs.	What holds the expansion plug in place, its function, and precautions.	
4. Removing and replacing fan assembly: (a) Fan belt adjustment.	Types of fan assemblies. Precautions.	
5. Removing, reconditioning and replacing water pumps.	Method of dismantling, repairing and assembling water pump; reasons for pump failure.	
6. Winterizing by use of antifreeze.	Specifications: volume of cooling system, amount of antifreeze required to safeguard against freezing, rust inhibitors, use of antifreeze testers.	13
7. Checking coal system.	Cause of leaks, how to locate internal and external leaks and how to repair them.	9
D. Fuel System		
1. Disassembling and assembling fuel pumps, single and dual.		2
2. Disassembly and assembly of carburetors: (a) Adjusting float level metering rod. (b) Fast idle, anti-percalator automatic choke, unloader, idle.	Principles of operation, basic circuits.	9

Work Activities	Basic Information	References
(c) Tracing idle, low speed, intermediate speed, power, automatic choke, circuits.		
F. Electrical		
1. Disassembling and assembling starters, generators, distributors.	Operation of distributor advance units, operation of various types of bendix or starter drive units.	1 4
G. Tune-Up (A maximum of 60 hours to be spent on the unit of Tune-Up)		
I. Preliminary check.	Importance of overt inspection for obvious difficulties such as broken wires, loose connections, etc. Importance of examination of data which should include the type of driving done, the mileage the car has been driven, and the weather to which the car has been subjected.	
II. Oscilloscope test and/or road test	Importance of a more exacting analysis of the cause of trouble. Application of test procedures.	
NOTE: In actual practice, the preliminary check and/or oscilloscope test may lead directly to only one of the sections outlined below.		
A. Electrical		
1. Check battery.	Proper care and maintenance Standard battery tests; e.g. - hydrometer, high rate discharge test, "Battery Light Load Test" (this is preferred by some manufacturers to the "High Rate Discharge Test") Stress the importance of a good battery for a well functioning ignition.	

Work Activities	Basic Information	References
2. Check low voltage wiring circuit	Review Ohm's Law so that students will understand what it is that the ohmmeter, ammeter and voltmeter measure. Relationship between electricity and magnetism. (Necessary for an understanding of the high voltage circuit). Use of the voltmeter and ammeter testing for voltage drop and current draw at strategic points pertaining to starting and running of the engine. Methods of finding "shorts", "Open circuits" and poor connections. Theory of operation of the primary ignition circuit.	
3. (a) Inspect, replace and adjust distributor points. Test condenser.	Point burning characteristics and their relation to coil and condenser operation. Use of feeler gauges and dwell meter in point setting. Use of condenser tester and purpose of condenser.	
(b) Test distributor operation in drive tester. Remove and replace worn parts.	Purpose of advance mechanisms. Causes of high speed ignition failure. Importance of dwell angle. Correct point opening not necessarily correct dwell. Causes of incorrect dwell. Importance of correct point alignment.	
4. Remove, clean, adjust and replace spark plugs.	Simple methods of testing misfiring of an engine. Spark plug construction and operation. Engine analysis with repsect to spark plug appearance. Cylinder numbering.	
5. Check high voltage wiring.	Firing order. Types and faults of wiring.	
6. Test engine compression.	Note testing procedure for faulty valves, rings, head gaskets, carbon deposits.	
7. Test ignition coil.	Use of coil tester. Purpose of resistance (low and high voltage) Polarity of coil. Theory of "transformer" action of the coil.	

Work Activities	Basic Information	References
8. Adjust ignition timing.	Primary timing with engine stopped. Use of timing light and tachometer on the running engine.	
B. Fuel System		
1. Test fuel pump.	Importance of checking fuel pump flow volume as well as pressure. Causes of insufficient flow. Use of pressure/vacuum gauge in test. Problems with vapor lack and foreign matter in lines.	
2. Inspect, clean, replace filters and sediment bowls.	Review theory of carburetor. Basic circuits - why necessary parts required operation of. Operation of two and four barrel carburetors.	
3. Remove, clean, inspect, adjust and replace parts of carburetor.		Manufacturers' Manuals.
4. Make external adjustments of carburetor on car.	Use of vacuum gauge and tachometer. Importance of proper operation of automatic choke.	
5. Service air cleaner.	Possible effects of dirty or plugged air cleaners. Correct procedure for servicing. Correct positioning of snorkel type air cleaners.	
6. Service positive crankcase ventilating system.	Purpose of ventilators. Effect if plugged. Servicing.	Manufacturers' Manuals.
C. Other		
1. Adjust tappets and determine valve lift.	Use of vacuum gauge. Importance of adequate "breathing" in engine. Importance of proper valve timing.	
2. Inspect and loosen heat riser valve.	Importance of proper volumetric efficiency.	

Work Activities	Basic Information	References
H. Guidance Information		
1. Obtain speaker from the Apprenticeship Board. 2. Panel discussion.	The Apprenticeship Program: Entrance procedure Requirements Training received Journeyman's qualifications	Apprenticeship Brochures
3. Talk; panel discussion and visitation.	Technical Institute program	Institute Announcements.
4. Lecture and films.	University (a) Entrance qualifications. (b) Programs available.	University Calendars.
5. Committee reports.	Breadth of field: Journeyman mechanic Service sales Parts and accessories Managerial Opportunities in industries serving the automotive industry e.g. Tool and equipment manufacturers.	
I. Business Organization		
1. Lecture, filmstrips and pamphlets. 2. Committee Reports.	Retail Dealer Organization Service department: (a) Shop - general organization and personnel duties (b) Foremen - duties and responsibilities (c) Service salesmen (d) Control tower operator (e) Service manager (f) Cashier	
3. Committee Reports.	Service literature: (a) Service bulletins (b) Repair manuals (c) Time schedules (d) Written forms - work orders and service station billing	

Work Activities	Basic Information	References
4. Lectures.	Parts department: (a) Counter service (b) Sales	
	Used Car Department: (a) Service (b) Sales	
	New Car and Truck Department: (a) Service (b) Sales	
	Business office: (a) Timekeeper (b) Accountant (c) General manager (d) Dealer	
	Service Stations and Small Garages: (a) Personnel (b) Stock	
	Wholesale Dealer Organizations: (a) Personnel (b) Stock	

REFERENCE BOOKS

1. Text: AUTOMOTIVE FUNDAMENTALS, by F. C. Nash, 1962, McGraw-Hill.
2. Text: AUTOMOTIVE MECHANICS, by Wm. H. Crouse, 4th edition, McGraw-Hill.
3. Text: AUTOMOTIVE ELECTRICAL EQUIPMENT, by Wm. H. Crouse, McGraw-Hill.
4. Text: AUTOMOTIVE MECHANICS - PRINCIPLES AND OPERATION, by M. J. McGuffin, Macmillan Company of Canada, 1962.
5. Text: MOTOR SERVICE'S AUTOMOTIVE ENCYCLOPEDIA, by Wm. K. Toboldt and Jud Purvis, School Edition, 1962, Goodheart-Willcox Co., Inc.
6. Text: NATIONAL SERVICE DATA, National Automotive Service, 142 Drumen St. San Francisco, 11, California. (Substitute for manufacturers manuals - supplement published every six months.)
7. Text: AUTOMOTIVE DRAFTING INTERPRETATION, Thomas - Delmar Publication, distributed by Thomas Nelson & Sons Ltd., Toronto.
8. Text: AUTOMOTIVE TRANSMISSIONS, by Wm. H. Crouse, McGraw-Hill.
9. Text: AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS, by Wm. H. Crouse, McGraw-Hill.
10. Text: BRAKE WORK FOR AUTO MECHANICS, Delmar Publishing Co., Thomas Nelson & Sons (dist).
11. Text: BRAKE SERVICE MANUAL, Mintex, Toronto.
12. Text: SHEET METAL HAND PROCESSES, Delmar publication, Thomas A. Nelson & Sons Ltd.
13. Text: UNDERSTANDING YOUR CAR, by S. C. Beeler, General Publishing Co.
14. Text: EXPLORING AUTO MECHANICS, by Harold T. Glenn, Charles A. Bennett Co.
15. Text: AUTOMOTIVE ENGINES, by Wm. H. Crouse, McGraw-Hill.
16. Text: JUST WHAT IS A PIN FIT?, Sunnen Corporation Ltd.

TL 152 A333 1963
ALBERTA DEPT OF EDUCATION
AUTOMOTIVES 12-22-32 --

NL 40148452 CURR HIST

000037747870

DATE DUE SLIP

F255